

REMARKS

This is a full and timely response to the non-final Office Action of June 29, 2004.

Reexamination, reconsideration, and allowance of the application and all presently pending claims are respectfully requested.

Upon entry of this First Response, claims 1-48 and 57-64 are pending in this application.

Claims 12-20 and 57 are allowed, and claims 58-64 are newly added. Further, claims 1 and 39 are directly amended herein, and claims 49-56 are canceled without prejudice or disclaimer. It is believed that the foregoing amendments add no new matter to the present application.

Response to §102 Rejections

A proper rejection of a claim under 35 U.S.C. §102 requires that a single prior art reference disclose each element of the claim. See, e.g., *W.L. Gore & Assoc., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 U.S.P.Q. 303, 313 (Fed. Cir. 1983).

Claim 1

Claim 1 presently stands rejected under 35 U.S.C. §102 as allegedly being anticipated by *Nicolas* (U.S. Patent No. 5,453,797). Claim 1 reads as follows:

1. An apparatus for correlated noise reduction, the apparatus comprising:
a trellis decoder, the trellis decoder operative to provide decoded data and a trellis error signal, the trellis error signal formed as a decision error of a selected previous state of a selected trellis path;
a linear feedforward equalizer, the linear feedforward equalizer having as input a received data signal, the linear feedforward equalizer operatively coupled to the trellis decoder for adaptation to the trellis error signal to modify a first plurality of equalization coefficients $a(n)$; and
a noise predictor, the noise predictor operatively coupled to the linear feedforward equalizer to provide an input to the trellis decoder, *the noise predictor having as input a tentative error signal, the tentative error signal formed as a difference between a tentative symbol decision by the trellis decoder and a delayed received data signal* subsequent to equalization, the noise predictor operatively

coupled to the trellis decoder for adaptation to the trellis error signal to modify a plurality of correlated noise reduction coefficients $c(n)$. (Emphasis added).

Applicants respectfully assert that the cited art fails to disclose at least the features of claim 1 highlighted hereinabove. Accordingly, the 35 U.S.C. §102 rejection of claim 1 is improper.

In trellis coded modulation, analog data signals are received and decoded by a trellis decoder to provide digital symbols representative of the received signals. When a particular sample of an analog data signal is initially received by the decoder, several states of the corresponding digital symbol are possible. However, only certain sequences of states from symbol-to-symbol are allowed in trellis coded modulation. Thus, over time, the trellis decoder may use information gleaned from the states of several consecutive symbols to eliminate possible states of the current symbol to be output from the decoder. The use of such information results in a relatively accurate symbol decision. Unfortunately, a significant amount of delay is introduced by the decoder as it eliminates possible states and state branches to arrive at a more accurate symbol decision.

Many trellis decoders are configured to provide an error signal associated with each decoded symbol. The error signal is indicative of the difference between the value of the decoded symbol and the value of the corresponding data signal sample, and the error signal may be used to update the coefficients of other receiver components, such as filters. *Nicolas* appears to disclose such a trellis decoder 1322 (FIG. 13) that outputs a decoded symbol, A_k , and the output of element 1320 appears to represent the decoder error associated with the decoded symbol.

A trellis decoder described by the instant application, like conventional trellis decoders, employs trellis coded modulation techniques to make a symbol decision for a received data signal. However, as noted above, there is a delay between the trellis decoder receiving the data signal and the trellis decoder making a corresponding symbol decision for the received data signal. During this delay, the trellis decoder of the present invention defined by claim 1 makes a “tentative symbol decision” for the received data signal. Such a symbol decision is “tentative” in that the decoder has

yet to make a final decision on the symbol's value. Since the tentative symbol decision is made prior to the final symbol decision, it is likely that a "tentative symbol decision" for a received data signal will be less accurate than the subsequent final symbol decision for the data signal. Nevertheless, the present application teaches that a "tentative error signal," which is "formed as a difference between (the) tentative symbol decision and a delayed received data signal" may be used to update a "noise predictor." The cited art fails to teach such features.

In particular, the trellis decoder of *Nicolas*, like other conventional decoders, appears to make a symbol decision for each received data signal sample. Once this decision is made, the selected symbol, A_k , for the sample is apparently output from the decoder. There is nothing in *Nicolas* to indicate that an additional "tentative" symbol decision for the sample is made or that a "tentative error signal" is formed from any such "tentative" decision.

For at least the above reasons, Applicants assert that the cited art fails to disclose at least the features of claim 1 highlighted above. Accordingly, the 35 U.S.C. §102 rejection of claim 1 should be withdrawn.

Claims 2-11

Claims 2-11 presently stand rejected in the Office Action under 35 U.S.C. §102 as allegedly being anticipated by *Nicolas*. Applicants submit that the pending dependent claims 2-11 contain all features of their respective independent claim 1. Since claim 1 should be allowed, as argued hereinabove, pending dependent claims 2-11 should be allowed as a matter of law for at least this reason. *In re Fine*, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988).

Claim 21

Claim 21 presently stands rejected under 35 U.S.C. §102 as allegedly being anticipated by *Nicolas*. Claim 21 reads as follows:

21. A method of correlated noise reduction, the method comprising:
 - (a) receiving a data signal to form a received data signal;
 - (b) determining a trellis error signal as a decision error of a selected previous state of a selected trellis path;
 - (c) equalizing a received data signal utilizing a first plurality of equalization coefficients $a(n)$ to form an equalized data signal and modifying the first plurality of equalization coefficients $a(n)$ in response to the trellis error signal;
 - (d) *determining a tentative error signal as a difference between a tentative symbol decision and a delayed equalized data signal;*
 - (e) reducing correlated noise in the equalized data signal utilizing a plurality of correlated noise reduction coefficients $c(n)$ and *modifying the plurality of correlated noise reduction coefficients $c(n)$ in response to the trellis error signal and with input of the tentative error signal.* (Emphasis added).

For at least the reasons set forth above in the arguments for allowance of claim 1, Applicants submit that the cited art fails to disclose at least the features of claim 21 highlighted above. Accordingly, the 35 U.S.C. §102 rejection of claim 21 should be withdrawn.

Claims 22-29

Claims 22-29 presently stand rejected in the Office Action under 35 U.S.C. §102 as allegedly being anticipated by *Nicolas*. Applicants submit that the pending dependent claims 22-29 contain all features of their respective independent claim 21. Since claim 21 should be allowed, as argued hereinabove, pending dependent claims 22-29 should be allowed as a matter of law for at least this reason. *In re Fine*, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988).

Claim 30

Claim 30 presently stands rejected under 35 U.S.C. §102 as allegedly being anticipated by *Nicolas*. Claim 30 reads as follows:

30. An apparatus for correlated noise reduction, the apparatus comprising:
means for receiving a data signal to form a received data signal;
means for determining a trellis error signal as a decision error of a selected previous state of a selected trellis path;
means for equalizing a received data signal utilizing a first plurality of equalization coefficients $a(n)$ to form an equalized data signal and modifying the first plurality of equalization coefficients $a(n)$ in response to the trellis error signal;
means for determining a tentative error signal as a difference between a tentative symbol decision and a delayed equalized data signal;
means for reducing correlated noise in the equalized data signal utilizing a plurality of correlated noise reduction coefficients $c(n)$ and *modifying the plurality of correlated noise reduction coefficients $c(n)$ in response to the trellis error signal and with input of the tentative error signal.* (Emphasis added).

For at least the reasons set forth above in the arguments for allowance of claim 1, Applicants submit that the cited art fails to disclose at least the features of claim 30 highlighted above. Accordingly, the 35 U.S.C. §102 rejection of claim 30 should be withdrawn.

Claims 31-38

Claims 31-38 presently stand rejected in the Office Action under 35 U.S.C. §102 as allegedly being anticipated by *Nicolas*. Applicants submit that the pending dependent claims 31-38 contain all features of their respective independent claim 30. Since claim 30 should be allowed, as argued hereinabove, pending dependent claims 31-38 should be allowed as a matter of law for at least this reason. *In re Fine*, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988).

Claim 39

Claim 39 presently stands rejected under 35 U.S.C. §102 as allegedly being anticipated by *Nicolas*. Claim 39 reads as follows:

39. A system for reduction of correlated noise during data transmission, the system comprising:

 a transmitter, the transmitter operative to transmit a training signal and to transmit a data signal; and

 a receiver couplable to the transmitter via a communication channel, the receiver further comprising:

 a trellis decoder, the trellis decoder operative to provide decoded data and a trellis error signal, the trellis error signal formed as a decision error of a selected previous state of a selected trellis path;

 a linear feedforward equalizer, the linear feedforward equalizer having as input a received data signal, the linear feedforward equalizer operatively coupled to the trellis decoder for adaptation to the trellis error signal to modify a first plurality of equalization coefficients $a(n)$; and

 a noise predictor, the noise predictor operatively coupled to the linear feedforward equalizer to provide an input to the trellis decoder, *the noise predictor having as input a tentative error signal, the tentative error signal formed as a difference between a tentative symbol decision by the trellis decoder and a delayed received data signal* subsequent to equalization, the noise predictor operatively coupled to the trellis decoder for adaptation to the trellis error signal to modify a plurality of correlated noise reduction coefficients $c(n)$. (Emphasis added).

For at least the reasons set forth above in the arguments for allowance of claim 1, Applicants submit that the cited art fails to disclose at least the features of claim 39 highlighted above. Accordingly, the 35 U.S.C. §102 rejection of claim 39 should be withdrawn.

Claims 40-48

Claims 40-48 presently stand rejected in the Office Action under 35 U.S.C. §102 as allegedly being anticipated by *Nicolas*. Applicants submit that the pending dependent claims 40-48 contain all features of their respective independent claim 39. Since claim 39 should be allowed, as argued

hereinabove, pending dependent claims 40-48 should be allowed as a matter of law for at least this reason. *In re Fine*, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988).

Claim 58

Claim 58 has been newly added via the amendments set forth herein. Claim 58 presently reads as follows:

58. An apparatus for correlated noise reduction, the apparatus comprising:
a trellis decoder operative to receive a sample of an analog data signal and to decode the sample, the trellis decoder further configured to make a first symbol decision for the sample and to provide an error signal based on the first symbol decision, wherein the trellis decoder in decoding the sample is configured to make a second symbol decision for the sample and to transmit a decoded for the sample symbol based on the second symbol decision, the second symbol decision occurring after the first symbol decision; and
a noise predictor operative to update a plurality of correlated noise reduction coefficients based on the error signal.

Applicants assert that the cited art fails to disclose or teach each of the above features of claim 58. Accordingly, claim 58 is allowable.

Claim 59 and 60

Claims 59 and 60 have been newly added via the amendments set forth herein. Applicants submit that the pending dependent claims 59 and 60 contain all features of their respective independent claim 58. Since claim 58 should be allowed, as argued hereinabove, pending dependent claims 59 and 60 should be allowed as a matter of law for at least this reason. *In re Fine*, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988).

Claim 61

Claim 61 has been newly added via the amendments set forth herein. Claim 61 presently reads as follows:

61. A method for correlated noise reduction, the method comprising:
receiving a sample of an analog data signal;
decoding the sample thereby providing a decoded symbol that corresponds to the sample, wherein the decoding comprises making a first symbol decision for the sample and making a second symbol decision for the sample after the first symbol decision;
transmitting a symbol based on the second symbol decision;
providing, prior to the second symbol decision, an error signal corresponding to the first symbol decision; and
updating a plurality of noise reduction coefficients based on the error signal.

Applicants assert that the cited art fails to disclose or teach each of the above features of claim 61.

Accordingly, claim 61 is allowable.

Claims 62-64

Claims 62-64 have been newly added via the amendments set forth herein. Applicants submit that the pending dependent claims 62-64 contain all features of their respective independent claim

61. Since claim 61 should be allowed, as argued hereinabove, pending dependent claims 62-64 should be allowed as a matter of law for at least this reason. *In re Fine*, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988).

CONCLUSION

Applicants respectfully request that all outstanding objections and rejections be withdrawn and that this application and all presently pending claims be allowed to issue. If the Examiner has any questions or comments regarding Applicants' response, the Examiner is encouraged to telephone Applicants' undersigned counsel.

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